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Addendum to the Bear Gulch Mine Complex Environmental Evaluation / Cost Analysis (EE/CA) Developed for Removal of Wastes at the Beartop-Orofino Mill Site, Bear Gulch Creek, Shoshone County, Idaho

1.0 ***Introduction:*** The U.S. Forest Service commissioned a site investigation of the Bear Gulch Mine Complex that was completed by Maxim Technologies Inc (Maxim 2003a). Based on the site investigation Maxim developed the Bear Gulch Mine Complex EE/CA that was published as "draft final" (Maxim 2003b). Based on these documents the Forest Service concluded that the large majority of any hazardous wastes associated with the Bear Gulch Mine Complex is located at the Beartop-Orofino Mill site on private land. The Forest Service does not exercise its CERCLA 106 authorities on private land. For this reason, the draft final EE/CA was not placed out for comment by the public and was not finalized. The Beartop-Orofino Mill site was referred to DEQ for remedial action.

The Bear Gulch Mine Complex EE/CA characterizes the mine wastes and their location in the mine complex (Maxin 2003b) (Figure 1). It develops a streamline risk assessment, and specifies remedial objectives, lays out four rather general remedial alternatives for the entire complex, and compares these alternatives. No preferred alternative is designated by the EE/CA. Addressing the Beartop-Orofino Mill site independent of the other sites located in the Bear Gulch Mine Complex requires greater specificity of the remedial alternatives for this site. This addendum to the Bear Gulch Mine Complex EE/CA:

1) Restates the remedial action scope and objectives specific to the Beartop-Orofino Mill site.
2) Specifies four specific alternatives for remediation of the Beartop-Orofino Mill site.
3) Compares these alternatives based on the criteria specified by the EPA guidance (1993).
4) Chooses a preferred alternative to which the public can respond.

2.0 ***Removal Action Scope and Objectives:*** The removal action scope and objectives are restated here for the Beartop-Orofino Mill site. These are drawn from the Maxim developed EECA. The remedial action objectives include:

- Reduce or eliminate human health hazards associated with metals contamination
- Reduce or eliminate hazards to the environment presented by sediment and metals contamination of Bear Gulch Creek.
- Improve aquatic health and habitat.

The applicable regulatory and appropriate requirement (ARAR) guidelines for the remedial efforts would be the state water quality criteria for metals stated in Table 1.

Table 1: Idaho water quality standards for metals of concern at the Beartop-Orofino Site.

Dissolved Metal (micrograms per liter) at hardness of 25 mg/ L $CaCO_3$				
	Cadmium	Copper	Lead	Zinc
Standard	0.37	3.5	0.54	32

The risk based guidelines for sediment and soil are provided in Table 2. The guidelines are based on the Bunker Hill Mining and Metallurgical Complex Operable Unit 3 Record of Decision (EPA 2002).

Table 2: Risk based guidelines for sediment and soil at the Beartop-Orofino Site.

	Total Metals (milligrams per kilogram)		
	Cadmium	Lead	Zinc
Human Health[1]	-	1,000	-
Sediment Guideline[2]	2.7	171	280
Soil Guideline[3]	105	159	434

1. Guideline from EPS (2002) for public recreational activities
2. Concentration for sediment protective of aquatic organisms (EPA 2002)
3. Concentrations protective of terrestrial wildlife (EPA 2002)

The remedial work will be completed to soil lead concentrations sub-500 ppm as measured by x-ray fluorescence (XRF). Experience from other removals indicates that once the lower strata of mine wastes is reached, lead values decrease remarkably below 500 ppm. Since lead is easily and fairly accurately estimated with an XRF unit, it will serve as a surrogate for the other metals of concern cadmium and zinc.

3.0 ***Remedial Alternatives:*** Based on the general alternatives of the Bear Gulch Mine Complex EE/CA, four alternatives were developed for remediation of the Beartop-Orofino Mill site. These alternatives are described in more detail in Table 3. The alternatives range from the required no action alternative through both on-site and off-site removal options. The on-site removal option would require a repository be constructed outside of the floodplain in the vicinity of the Beartop-Orofino Mill site. The off-site removal alternatives would export the wastes 13 miles to the Eagle Creek Repository. Wastes would be placed in a modification of the existing Monarch cell of that repository. The cell would then be closed for the final time. The second off-site removal option is modified with removal of only the 1 inch minus fraction of the alluvium after a sorting process is completed. This option minimizes the space necessary to contain wastes from the Beartop-Orofino Mill site in the existing repository cell.

TABLE 3

SUMMARY OF REMOVAL ALTERNATIVES

ALTERNATIVE	DESCRIPTION
1	**No Action**
2 **Removal of Contaminated Materials for Off-Site Disposal**	***Jig Tailings*** **- The jig tailings approximately 700 cubic yards, would be removed and transported off-site to the USFS Eagle Creek repository for disposal in the Monarch Cell. The area where the jig tailings were located would be regraded and revegetated with native grasses. No backfill would be placed in this area.** **Concentrates – Concentrates from the loading area, approximately 122 cubic yards, would be removed and transported off-site to the USFS Eagle Creek repository for disposal in the Monarch Cell. The area where the concentrates were located would be re-graded and re-vegetated with native grasses. No backfill would be placed in this area** ***Jig Tailings/Alluvium Mixture*** **- The jig tailings/alluvium approximately 9,810 cubic yards, would be removed and transported off-site to the USFS Eagle Creek repository for disposal in the Monarch Cell. The area where the jig tailings were located would be re-graded and re-vegetated with native grasses. No backfill would be placed in this area.**
3 ***Removal of Contaminated Material for On-Site Disposal and Capping***	***Jig Tailings*** **- The jig tailings approximately 700 cubic yards, would be removed and transported to an on-site repository just out of the Bear Gulch Creek floodplain. Construction of the repository will include clearing and grubbing the area, constructing French drain system as an under drain for the repository, placing and grading contaminated materials, and capping the entire area with one foot of imported clean soil (2,200 cubic yards). The area where the jig tailings were located would be re-graded and re-vegetated with native grasses. No backfill would be placed in this area.** **Concentrates – Concentrates from the loading area, approximately 122 cubic yards would be removed and transported to the on-site repository described above. The area where the concentrate was located would be re-graded and re-vegetated with native grasses. There would be no backfill placed in this area.** ***Jig Tailings/Alluvium Mixture*** **- The jig tailings/alluvium mixture approximately 9,810 cubic yards, would be removed and transported to the on-site repository described above. The jig tailings/alluvium mixture has an average depth of two feet, however locally the depth of contaminated material removed will range from zero to four feet. The area where the jig tailings/alluvium mixture was located would be re-graded and re-vegetated with native grasses. There would be no backfill placed in this area.**
4 ***Removal of Jig Tailings and minus ¾-inch Tailings/Alluvium Mixture for Off-Site Disposal***	***Jig Tailings and Concentrates*** **- The jig tailings and concentrates will be disposed as described in Alternative 2.** ***Jig Tailings/Alluvium Mixture*** **- The jig tailings/alluvium mixture will be screened and the minus 1-inch material, approximately 4,611 cubic yards will be disposed in the Eagle Creek repository as described in Alternative 2. The area where the jig tailings/alluvium mixture was located would be re-graded and re-vegetated with native grasses. Those portions of the stream affected would be re-shaped and stabilized. There would be no backfill placed in this area.**

4.0 ***Analysis of the Removal Alternatives:*** EPA (1993) Guidance requires that removal alternatives be analyzed based on 1) effectiveness; 2) implementability; and 3) cost. Effectiveness is assessed in terms of several factors that include: 1) Overall protection of human health and the environment; 2) Compliance with ARARs; 3) Long term effectiveness and permanence; 4) Reduction in toxicity, mobility or volume through treatment; and 5) Short term effectiveness. Implementability is assessed based on: 1) Technical feasibility; 2) Maintenance and monitoring requirements; 3) Construction feasibility; and 4) Community acceptance. The final factor is cost.

4.1 Evaluation of Alternatives:

4.1.1 *Alternative 1 No action:* The "no action" alternative is required in all environmental assessments. It is a benchmark, from which to assess the environment improvement value of the action alternatives. If no action is taken at the Beartop-Orofino Mill site hazardous materials (metals and arsenic) will continue to be mobilized into the environment by wind and water erosion. The site will remain a threat to human health and the environment, while hazardous wastes are transported off site primarily down Bear Gulch Creek into Prichard Creek. Human health and the environment would not be protected. The ARARs would not be met in any reasonable time frame by natural attenuation at the site. The long term effectiveness will be poor. There will be no reduction in mobility and toxicity, while a larger volume of slightly less toxic material may develop. In the short term there would be no additional impact to the environment greater than that currently occurring. No action would require no implementation or and therefore no assessment of implementation or cost is necessary.

4.1.2 *Alternative 2: Removal of Wastes and Contaminated Alluvium to an Off-site Repository:* The alternative would remove tailings (700 cubic yards), concentrates (122 cubic yards) and contaminated alluvium (9,810 cubic yards) to an off –site repository. The repository would be the Monarch Cell of the Eagle Creek Repository.

Transport of the most hazardous wastes (tailings and concentrates) off-site and placement into a repository cell is protective of human health and the environment. The metals and arsenic would be placed in a location isolated from weathering and the influences of and transport by surface and ground water. Progress would be made towards meeting the ARARs, but post project monitoring would be required to confirm the effectiveness. Natural attenuation of the remaining material might be required for the water quality standards to be met. Permits would be obtained and the required best management practices put in place to meet the other ARARs. The long term effectiveness and permanence of a removal off-site would be high. The mobility of the toxic material would be dramatically curtailed, but the toxicity of the material and its volume would not be changed. It would be transferred to a more desirable site. Short term the alternative would cause some disturbance to the environment with excavation of the material and the transport road necessary to move it to the repository. This disturbance would likely abate in a season or two since only removal would occur on the site. The disturbance involved with the repository would be minimized, because the Monarch cell would be used to place the materials.

Alternative 2 is technically feasible to implement and typical of mine waste removal actions. Since the hazardous material will be housed in a repository operation and maintenance will be required. These expenses are relatively low for repositories. They involve yearly groundwater monitoring and inspection. The construction required by alternative 2 is feasible and typical of mine waste removal actions. Opening the Monarch cell to receive the materials and subsequent closure is unusual, but quite feasible.

The public acceptance of alternative 2 will be assessed in the decision document after public comment on the EE/CA and its addendum is received. The cost of the alternative is lower than alternative 3, but somewhat higher than alternative 4 (Table 4).

4.1.3 Alternative 3: *Removal of Wastes and Contaminated Alluvium to an On-site Repository:* The alternative would remove tailings (700 cubic yards), concentrates (122 cubic yards) and contaminated alluvium (9,810 cubic yards) to an on –site repository.

Transport of the most hazardous wastes (tailings and concentrates) to an on-site repository cell is protective of human health and the environment. The metals and arsenic would be placed in a location isolated from weathering and the influences of and transport by surface and ground water. Progress would be made towards meeting the ARARs, but post project monitoring would be required to confirm the effectiveness. Natural attenuation of the remaining material might be required for the water quality standards to be met. Permits would be obtained and the required best management practices put in place to meet the other ARARs. The long term effectiveness and permanence of a removal on-site might not be high. Bear Gulch is very narrow and has very steep slopes on either side. A repository that would not be subject to failure or undermined by the stream would be more difficult to assure. The mobility of the toxic material would be dramatically curtailed as long as the repository remained intact, but the toxicity of the material and its volume would not be changed. It would be transferred to a more desirable site, but the stability of that site would be more difficult to assure. Short term the alternative would cause greater disturbance to the environment than alternative 2. The material excavation and the transport road necessary to move it to the repository would be similar, but construction of the repository would cause far more disturbance. This disturbance would likely abate in a few seasons.

Alternative 3 may not be technically feasible. Considerable effort would be required to find a proper repository site and to design a stable repository. Since the hazardous material will be housed in a repository operation and maintenance will be required. These expenses are relatively low for repositories, but would cost more for alternative 3, because they would require application. The Eagle Creek repository already has the operation and maintenance features in place and operating. The construction required by alternative 3 is likely feasible. The removal and haul work is typical of mine waste removal actions, but the construction of a stable repository in the narrow and steep sided Bear Gulch might be problematic.

The public acceptance of alternative 3 will be assessed in the decision document after public comment on the EE/CA and its addendum is received. The cost of the alternative is higher than alternative 2 and 4. Construction of a new repository far outweighs the cost of hauling the wastes to the Eagle Creek Repository (Table 4).

4.1.4 Alternative 4: *Removal of Wastes and the One-inch Minus Sort of Contaminated Alluvium to an Off-site Repository:* The alternative would remove tailings (700 cubic yards), concentrates (122 cubic yards) and the one –inch minus sort of the contaminated alluvium (approximately 4,611 cubic yards) to an off –site repository.

Transport of the most hazardous wastes (tailings, concentrates and the contaminated fraction of the alluvium) to an on-site repository cell is protective of human health and the environment. The metals and arsenic would be placed in a location isolated from weathering and the influences of and transport by surface and ground water. Progress would be made towards meeting the

ARARs, but post project monitoring would be required to confirm the effectiveness. Natural attenuation of the remaining material might be required for the water quality standards to be met. Permits would be obtained and the required best management practices put in place to meet the other ARARs. The long term effectiveness and permanence of a removal off-site would be high. The mobility of the toxic material would be dramatically curtailed, but the toxicity of the material and its volume would not be changed. It would be transferred to a more desirable site. Short term the alternative would cause some disturbance to the environment with excavation of the material and the transport road necessary to move it to the repository. This disturbance would likely abate in a season or two since only removal would occur on the site. The disturbance involved with the repository would be minimized, because the Monarch cell would be used to place the materials.

Alternative 4 is technically feasible to implement and contains many aspects of a typical of mine waste removal actions. Alluvium sorting was thoroughly assessed during the Monarch Mill site removal action (DEQ 2006). Not only was it feasible, but it proved to be quite cost efficient. Removing only the contaminated fraction saved on transport and repository costs. These savings far outweighed the sorting expense. Since the hazardous material will be housed in a repository operation and maintenance will be required. These expenses are relatively low for repositories. They involve yearly groundwater monitoring and inspection. The construction required by alternative 4 is feasible including the alluvium sorting and typical of mine waste removal actions. Opening the Monarch cell to receive the materials and subsequent closure is unusual, but quite feasible.

The public acceptance of alternative 4 will be assessed in the decision document after public comment on the EE/CA and its addendum is received. The cost of the alternative is less than alternative 2 and 3 (Table 4).

Table 4: Estimated costs of Beartop-Orofino removal action.

Alternative	**Excavation, haul and placement** [1.]	**Alluvium Sorting** [2.]	**Repository** [3.]	**Mobilization/ Demobilization** [4.]	**Total**
No Action (Alt 1)	N/A	N/A	N/A	N/A	N/A
Remove off-site repository (Alt 2)	$107,316	N/A	$118,800	$68,500	$294,616
Remove to on-site repository (Alt 3)	$101,004	N/A	$152,760	$68,500	$322,264
Remove to off-site repository; sort alluvium (Alt 4)	$63,450	$43,200	$60,480	$68,500	$245,386

1. Based on Monarch removal base cost of $10.84 upgraded to $11.84 per cubic yard for alternatives 2 and 4 (longer haul) and downgraded to $9.50 per cubic yard for alternative 3 (short haul).
2. Based on sorting cost for Monarch removal $4.79 per bulk cubic yard.
3. Based on repository cost of the Monarch cell $16.67 per compacted cubic yard pro-rated for cell re-use *alternatives 2 & 4), $12.00 per compacted cubic yard and upgraded for new repository in difficult terrain (alternative 3) $20.00 per compacted cubic yard.
4. Monarch removal action mobilization charge plus 14%.

4.2 Comparison of the Alternatives:

4.2.1. Overall Protection of Human Health and the Environment: The three alternatives that take action are protective of human health and the environment. Alternatives 2 and 4 are likely more protective, because mine wastes are removed to an established repository, while alternative 3 would develop a repository in an area with marginal attributes for a repository. The repository envisioned in alternative 3 would have a much higher likelihood of failure.

4.2.2. Compliance with ARARs: The three action alternatives would move the site towards compliance with ARARs. Post project monitoring would be required to assure compliance with the water quality standards. The envisioned action alternatives may achieve the standards or an additional period of natural attenuation may be required for these goals to be met. The other ARARs will be cover by the permit conditions required by the regulatory agencies and will be addressed with prescribed best management practices.

4.2.3. Long Term Effectiveness and Permanence: Alternatives 2 and 4 have the highest likelihood of long term effectiveness and permanence. The "no action" alternative would not address the release of hazardous wastes, while alternative 3 has the distinct possibility of ineffectiveness should the on-site repository fail. Given the challenging terrain of Bear Gulch this would be a possibility.

4.2.4. Reduction of Toxicity, Mobility and Volume through Treatment: None of the alternatives will reduce the toxicity or volume of the hazardous materials. The three action alternatives will reduce the mobility of the metals and arsenic by isolating them from wind and water erosion in a repository.

4.2.5. Short Term Effectiveness: Alternatives 2 and 4 will have the least short term impacts. Excavation, sorting and loading of materials occur on-site, while disturbance at the repository is minimized by reopening the Monarch cell. All the action alternatives would have short term haul road impacts. Alternative 3 would have greater on-site impacts associated with construction of a repository.

4.2.6 Implementability: Alternative 2 and 4 rely on technologies typical of mine waste removals and are the easiest to implement. Work at the Monarch Mill site demonstrated the implementation of an alluvium sorting strategy. Alternative 3 is more difficult to implement, because of the on-site repository and the challenging terrain found in the Bear Gulch area.

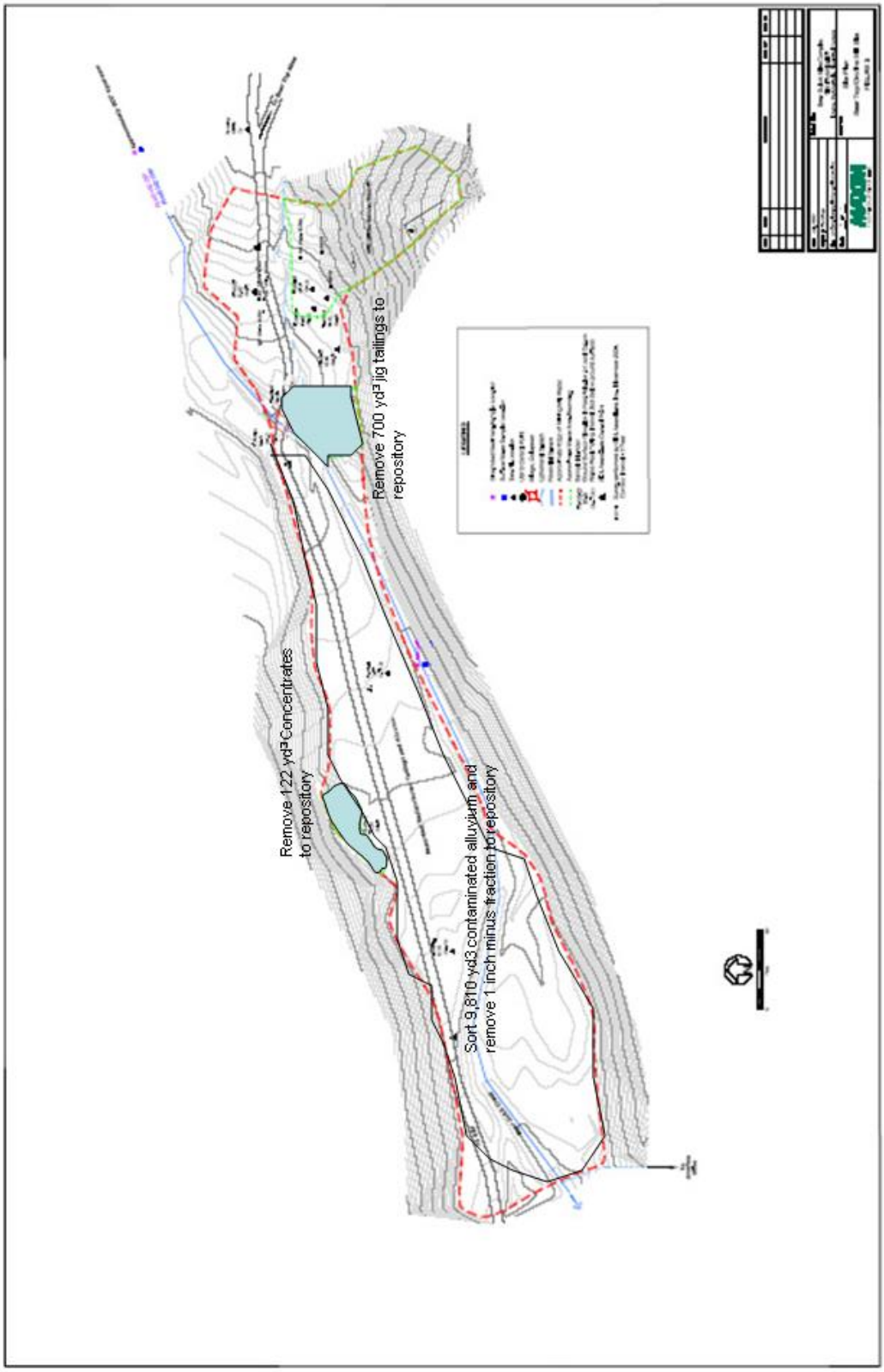
4.2.7. Cost: Alternative 4 is estimated as the least expensive. Work at the Monarch Mill site demonstrated that the savings in haul and repository costs are significantly larger than the expense required for sorting the alluvium (DEQ 2006). Alternates 2 and 4 share the savings created by adding the material to the existing Monarch cell of the Eagle Creek Repository. Alternative 3 is the most expensive, because it requires construction of a new repository.

5.0 *Preferred Alternative:* Comparison of the alternatives indicates that alternative 4 is the preferred alternative based on effectiveness, implementability and cost (Figure 1). The tailings (700 cubic yards) and concentrate (122 cubic yards) deposits will be removed to the Eagle Creek Repository. The contaminated alluvium estimated at 9,810 cubic yards will be sorted on-site and the 1-inch minus fraction estimated at 4,611 cubic yards exported to the repository. Removal areas will be reshaped and planted with native grasses.

The Bear Gulch road will be brushed out and widened slightly in locations to accommodate haul trucks. This activity will be required for roughly the mile and a half of road above its current use as a log haul road. Bear Gulch Creek will be temporarily bridged at crossings. Existing damaged culverts carrying intermittent streams will be replaced with rock structures specified by the Forest Service.

The Monarch cell of the Eagle Creek repository will be reopened to accept the materials from the Beartop-Orofino Mill site. A small depression in the feature that is residual from the Monarch removal will be filled. After the wastes are compacted to specifications, the cap will be re-established, top soil will be replaced and the area seeded with the prescribed grass mixture.

Figure 1: Preferred Plan for removal of hazardous wastes at the Beartop-Orofino Mill site.



6.0 *References:*

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EPA 1993 Guidance on conducting non-time-critical removal actions under CERCLA. EPA/540-R-93-057. Office of Emergency and Remedial Response. Washington D.C.

Maxim 2003a Final Site Investigation report, Bear Gulch Mine Complex Summit Mining District Idaho Panhandle National Forests Shoshone County, Idaho. Maxim Technologies Inc., P.O. Box 4699, Helena MT 59604. 62 p.

Maxim 2003b Bear Gulch Mine Complex engineering evaluation and cost analysis Idaho Panhandle National Forests Shoshone County, Idaho (draft final). Maxim Technologies Inc., P.O. Box 4699, Helena MT 59604. 70p.